Deepwater Development Facts

[OCS = Outer Continental Shelf; m = meters]

◆ Overview

✓ Deepwater drilling at water depths greater than 1,000 feet (305 m) is at an all-time high, and production from deepwater reservoirs is increasing. Over the past few years, deepwater operations in the Gulf of Mexico (GOM) have increased greatly. As of December 31, 1998, there were 31 rigs drilling simultaneously in GOM waters deeper than 1,000 feet.

✓ The Deep Water Royalty Relief Act, passed in 1995, has contributed significantly to the increase in deepwater activity by providing the opportunity to lease new prospects in deep water. The table at right reflects the impact this legislation has had on the GOM's activity in deeper waters.

Gulf of Mexico OCS Bids 1994-98 Before and After Royalty Relief

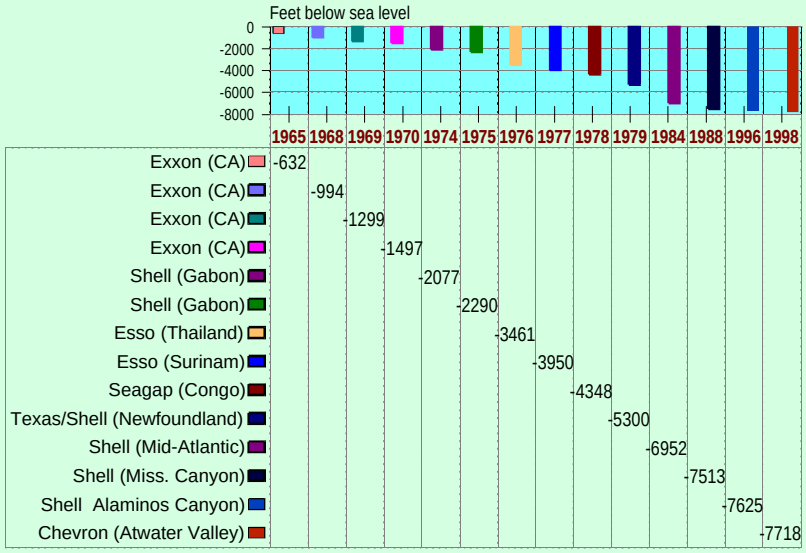
Water Depth	1994	1995	1996	1997	1998	5-Year Total
<200 m	490	516	637	542	280	2,465
200–400 m *	18	50	69	52	38	227
400–800 m *	28	83	113	104	61	389
>800 m *	49	214	722	1,138	817	2,940

* *Water depth categories defined by Deep Water Royalty Relief Act.*

✓ Deepwater classifications vary by application. MMS's deepwater classification for technological purposes begins at 1,312 feet (400 m) because the technology needed for developing and producing fields changes considerably around those water depths. Other depths such as 656 feet (200 m) and 2,625 feet (800 m) are used for various regulatory purposes.

✓ Deepwater operations are significantly different from conventional operations in shallower waters on the shelf. More sophisticated technology and technical expertise are needed to meet new technical and regulatory challenges. Advances in 3-D seismic technology, previous deepwater successes, and the Deep Water Royalty Relief Act encourage industry to search and drill for hydrocarbons farther offshore. Offshore industry operators joined efforts and formed the DeepStar Project to identify and develop economically viable methods to produce hydrocarbons from deepwater tracts in the GOM.

Deepwater Drilling Progression Worldwide



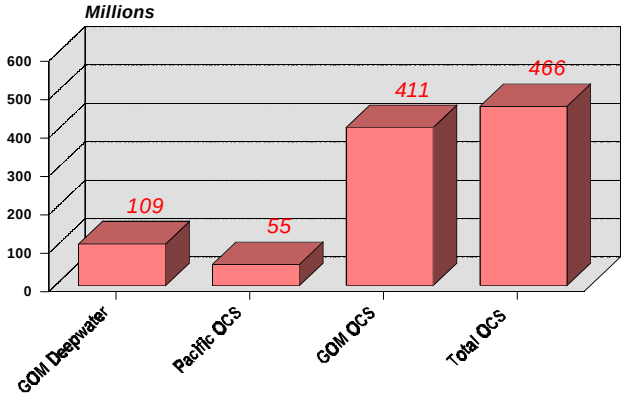
- One example of new platform technology used in GOM production is Oryx and CNG's Spar platform, Neptune, located in 1,930 feet (588 m) of water. Neptune represents the world's first production Spar. Other examples of the new technology include British-Borneo Exploration's mini-TLP, installed August 1998 in 1,700 feet (518 m) of water, and Amerada Hess's compliant tower, Baldpate, installed in 1,619 feet (493 m) of water, which is the only free standing compliant tower in the world.

- Shell Offshore, Inc. has led in GOM deepwater development activities since 1978 when the production platform, Cognac, was installed in 1,025 feet (336 m) of water. In 1994, Shell surpassed its initial deepwater record when Auger was installed in 2,861 feet (872 m) of water. In 1996, Shell and BP Exploration installed the Mars tension leg platform in 2,940 feet (896 m) of water. In 1997, Shell broke the world water depth for deepwater production (held by Petrobras) by almost 2,000 feet (656 m) with a well in the Mensa field at a water depth of 5,376 feet (1,764 m). However, Petrobras regained the record water depth for deepwater production and is the current record holder.

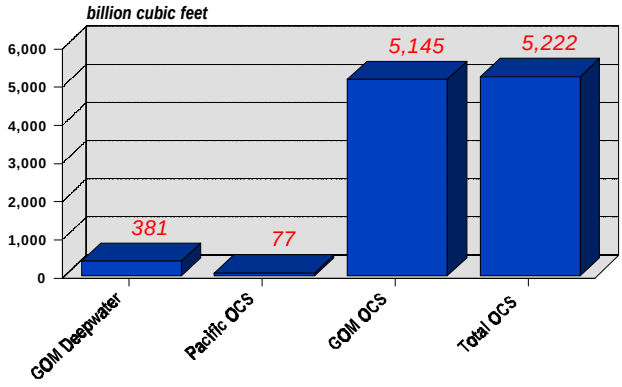
- In August 1998, Chevron U.S.A. set a new world record water depth for drilling an exploratory well in 7,718 feet (2,352 m) of water about 175 miles southeast of New Orleans, LA. This record eclipsed the previous record set in April 1996 in 7,620 feet (2,323 m) of water in the BAHA prospect, a joint venture owned by Shell, Amoco, Mobil, and Texaco.

- Production from the GOM's deepwater reservoirs is increasing and MMS expects deepwater natural gas and oil activities will continue to grow as operators explore and develop recently acquired and existing active leases. Production potential from proved and unproved reserves in the GOM's deep waters is estimated to be 1.82 billion barrels of oil and 5.81 trillion cubic feet of natural gas as of December 31, 1995. Deepwater production statistics for the years 1990–98 indicate the GOM's promising future.

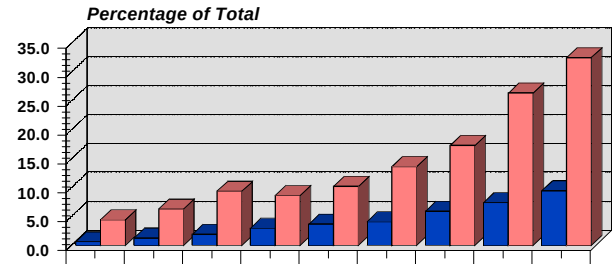
1997 U.S. Oil Production By Source



1997 U.S. Gas Production By Source



OCS GOM Deepwater* Production as a Percentage of Total GOM OCS Production



	1990	1991	1992	1993	1994	1995	1996	1997	1998**
Gas	0.6	1.3	1.9	3.0	3.7	4.1	5.9	7.4	9.5
Oil	4.4	6.3	9.4	8.6	10.2	13.7	17.3	26.4	32.5

* Water depths greater than 1,000 feet (305 m).
** Production through August 1998.

Deepwater Discoveries and Fields in the Gulf of Mexico

[Asterisk after the block number denotes a producing field. Of the 95 discoveries listed below, 25 are producing fields]

Project Name	Area	Block	Depth (ft)/(m)	Operator (Partner)
Coulomb	Mississippi Canyon	657	7500/2286	Shell
Metallica	Mississippi Canyon	911	7000/2128	BP Exploration
Herschel South	Mississippi canyon	520	6,739/2116	Amoco/Shell
King's Peak (SS)	Desoto Canyon	133	6530/1990	Amoco
Neptune	Atwater Valley	575	6220/1896	BP Exploration
Nakika[1](FPS)	Mississippi Canyon	383	5759/1755	Shell (Amoco)
King (SPAR)	Mississippi Canyon	84	5500/1676	Amoco
Mensa (SS)	Mississippi Canyon	687*	5376/1639	Shell
Diana South (SS)	Alaminos Canyon	65	4800/1463	Exxon
Hoover (Spar)	Alaminos Canyon	25/26	4785/1458	Exxon (BP)
Diana	East Banks	945	4500/1371	Exxon (BP)
Marshall	East Banks	948/949	4500/1371	Exxon
Atlantis	GreenCanyon	699	4500/1371	BP (BHP)
Poseidon	Green Canyon	691	4489/1368	BP
Crosby	Mississippi Canyon	899	4452/1357	BP
Mickey (SS)	Mississippi Canyon	211	4356/1328	Exxon (BP)
Narcissus	Mississippi Canyon	630	4250/1295	Texaco
Fuji	Green Canyon	506	4243/1293	Texaco (Shell)
Ursa (TLP)	Mississippi Canyon	809*	3916/1194	Shell (Exxon/BP/Conoco)
Zeus	Mississippi Canyon	941	3905/1190	Exxon
MC 837 (SS)	Mississippi Canyon	837	3900/1189	Walter
Europa (SS)	Mississippi Canyon	935	3870/1179	Shell (BP/Conoco)
King Kong[2]	Green Canyon	472	3817/1163	Conoco (Shell/BBEI)
Boomvang East	East Banks	688	3737/1139	Reading & Bates
Boomvang North	East Banks	643	3688/1124	Reading Bates (Norcen)
Macaroni (SS)	Garden Banks	602	3600/1097	Shell
Nile	Viosca Knoll	914	3535/1077	Amoco
Nirvana	Mississippi Canyon	162	3414/1041	BP Exploration
Gemini (Spar)	Mississippi Canyon	292	3393/1034	Texaco (Chevron)
Glider (TLP)	Green Canyon	248	3300/1006	Shell
Ram Powell (TLP)	Viosca Knoll	956*	3255/992	Shell(Exxon/Amoco)
King	Mississippi Canyon	764	3250/991	Vastar (Shell/BP)
Marlin (TLP)	Viosca Knoll	915	3236/986	Amoco
Sorano (SS)	Garden Banks	516	3153/961	Shell
Allegheny (TLP)(SS)	Green Canyon	254	3186/971	British-Borneo
MC 243	Mississippi Canyon	243	3100/945	Conoco (Oryx)
Gomez (Spar/TLP)	Mississippi Canyon	755	3000/914	Union Pacific
Mars (TLP) (SS)	Mississippi Canyon	807*	2940/896	Shell(BP)
Brutus (SS)	Green Canyon	158	2877/877	Shell (Exxon)
Auger (TLP)	Garden Banks	426*	2860/872	Shell (BP)
Pluto[3]	Mississippi Canyon	718	2828/862	Mariner (BP Exploration)
Troika (SS)	Green Canyon	244*	2721/828	BP Exp (Shell/Marathon)
Genesis (SPAR)	Green Canyon	205	2597/792	Chevron (Exxon/Fina)
Bison	Green Canyon	166	2518/767	Exxon
Leo	Mississippi Canyon	502/503/546	2500/760	British-Borneo(Shell)
Llano (SS)	Garden Banks	386	2300/701	EEX
Cooper (FPS)	Garden Banks	388*	2190/668	EEX (EP Operating)
Diamond (SS)	Mississippi Canyon	445*	2095/639	Oryx Energy
MC 443 (SS)	Mississippi Canyon	443	2095/639	Walter
Stellaria	Green Canyon	112	2045/623	Marathon/Shell
Angus (SS)	Green Canyon	113	2045/623	Marathon/Shell
Popeye (SS)	Green Canyon	116*	2000/609	Shell (CNG/Mobil/BP)
Neptune (SPAR)	Viosca Knoll	826*	1930/588	Oryx (CNG)
GB 254	Garden Banks	254	1920/585	Chevron USA
EW 1006 (SS)	Ewing Banks	1006	1884/574	Walter
Pompano II (SS)	Mississippi Canyon	28*	1865/568	BP (Kerr-McGee)
Black Widow (SS)	Ewing Banks	966	1850/564	Mariner
Arnold (SS)	Ewing Banks	963*	1800/549	Marathon
Rocky (SS)	Green Canyon	110*	1785/544	Shell
Petronius (CT)	Viosca Knoll	786	1754/535	Texaco (Marathon)
Knight	Garden Banks	372	1740/530	Santa Fe
Jolliet (TLP)	Green Canyon	184*	1720/524	Conoco
Thor (SS)	Viosca Knoll	825	1720/524	Oryx Energy
Grand Canyon	Green Canyon	141	1715/523	Conoco
GC 72 (SS)	Green Canyon	72	1655/504	Mobil
GC 228	Green Canyon	228	1638/499	Texaco
Baldpate (CT)	Garden Banks	260*	1641/500	Amerada Hess
Morpeth[4] (TLP) (SS)	Ewing Bank	965	1630/497	British-Borneo
GB 386	Garden Banks	386	1526/465	EEX
MC 441 (SS)	Mississippi Canyon	441	1520/463	Enserch (Agip/Fina)
Conger	Garden Banks	215	1500/457	Amerada Hess (Oryx)
Tahoe (SS)	Viosca Knoll	783*	1500/457	Shell (Murphy)
Zinc (SS)	Mississippi Canyon	354*	1478/450	Exxon
Toro	Green Canyon	69	1465/447	Shell
Penn State (SS)	Garden Banks	216	1450/442	Amerada Hess (Oryx)
Sunday Silence (TSpar)	Ewing Banks	958	1450/442	Tatham Offshore
Ladybug	Garden Banks	409	1355/413	Texaco (Unocal)
Bullwinkle (FP)	Green Canyon	62*	1353/412	Shell
Pompano I (FP)	Viosca Knoll	989*	1290/393	BP (Kerr-McGee)
MC 26	Mississippi Canyon	26	1272/388	BP
Oyster (SS)	Ewing Banks	917	1200/366	Marathon (Texaco)
Salsa	Garden Banks	171	1076/328	Amerada Hess
Virgo (FP)	Viosca Knoll	823	1130/344	Elf Exploration
Dulcimer (SS)	Garden Banks	367	1120/341	Mariner
Mosquito Hawk	Garden Banks	269	1102/336	Texaco
Alabaster (FP)	Mississippi Canyon	397*	1059/323	Exxon (Enserch/Walter)
VK 862 (SS)	Viosca Knoll	862*	1043/318	Walter
Shasta (SS)	Green Canyon	136*	1040/317	Texaco (Mariner)
Spirit (FP)	Viosca Knoll	780	1040/317	Shell
Amberjack (FP)	Mississippi Canyon	109*	1029/314	BP (Shell, Conoco)
Cognac (FP)	Mississippi Canyon	194*	1025/312	Shell
Seattle Slew (SS)	Ewing Banks	914*	1019/311	Tatham
Lena (CT)	Mississippi Canyon	281*	1018/310	Exxon
MC 533 (SS)	Mississippi Canyon	533	1000/305	Walter

[1] Ariel, Fourier, Herschel, and Keppler renamed to Nakika project. [2] Vancouver renamed to King Kong project [3] Blood Sweat & Tears renamed to Pluto project [4] Klamath renamed to Morpeth. FP=fixed platform, FPS = floating platform system, CT = compliant tower, TLP = tension leg platform, SS = subsea system, Spar = unit consisting of single point buoy tanker loading and mooring platform with storage tank, TSpar = truss Spar.

◆ Basic Systems Used for Deepwater Development in the Gulf of Mexico

- ✓ **Fixed Platform**–A jacket with a deck, providing space for crew quarters, drilling rigs, and production facilities. It's economical for installation in water depths up to 1,650 feet.

- ✓ **Compliant Tower**– A narrow, flexible tower and a piled foundation that can support a conventional deck for drilling and production operations. Unlike the fixed platform, the compliant tower can withstand forces while sustaining significant lateral deflections. It's usually used in water depths of 1,500–3,000 feet.

- ✓ **Sea Star**—Multiple-use tension leg platform designed for small fields with few well completions. It can be installed in water depths of 1,6–3,500 feet.

- ✓ **Floating Production System**—A semi-submersible with drilling and production equipment anchored in place with wire rope and chain to allow for vertical motion and with wellheads located on the ocean floor connected to the surface deck with production risers designed to accommodate platform motion. This system is usually used in water depths up to 6,000 feet or more.

- ✓ **Tension Leg Platform**—A floating structure held in place by vertical, tensioned tendons connected to the seafloor by templates secured with piles. The tensioned tendons have the advantage of broad water depth range and limited vertical motion. This system is used in water depths up to 7,000 feet.

- ✓ **Subsea System**—Single subsea wells producing to a nearby platform (fixed or tension-leg) to multiple wells producing through a manifold and pipeline system to a distant production facility. These systems are used in water depths up to 3,000 feet, but may be used in water depths up to 7,000 feet.

- ✓ **Spar Platform**—A large diameter single vertical cylinder supporting a deck. It has a typical fixed platform topside, three types of risers, and a hull moored using a taut caternary system of 6–20 lines anchored into the seafloor. This system is used in water depths up to 3,000 feet, but may be used in water depths up to 10,000 feet.